Industrial gas module

Model: ZC101

Version: 1.1

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Taiyuan Tengxing sensor technology Co., Ltd

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1. Description

Industrial gas module ZC101

The ZC101 industrial gas module uses a catalytic combustion sensor, a dedicated instrument amplifier, a high-precision processor, and an intelligent algorithm to convert the detected gas concentration into a recognizable digital signal for transmission through the serial port. It is convenient for users to use and debug, shortening the user's design and development cycle.

The module is equipped with a sensor with good linearity, high precision, fast response speed, and resistance to hydrogen sulfide and silicone interference. Combined with a temperature and humidity compensation algorithm, the module reliability is greatly improved. The module can meet the needs of different customers such as commercial restaurants, underground pipe galleries, petrochemicals, underground mines, etc. for the detection of combustible gases such as methane, propane, and isobutane.

2.Characteristics

(1)Multi-point calibration, calibration points can be flexibly set according to specific applications

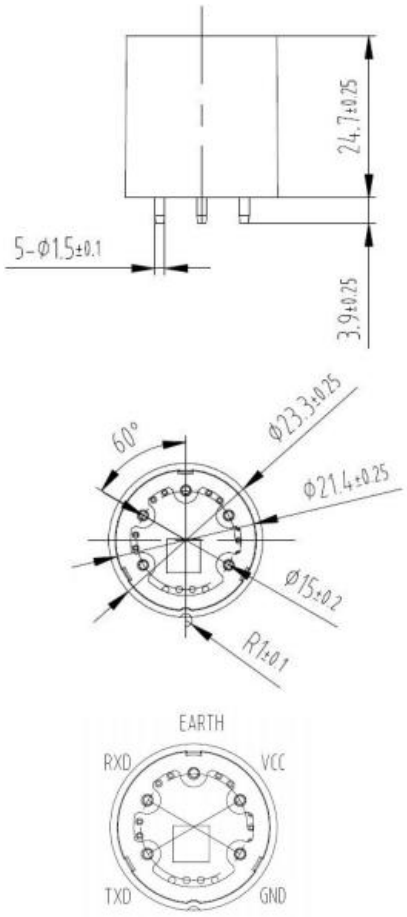
(2)UART signal output, temperature compensation

(3)High stability, strong anti-interference ability

3.Main Applications:

Widely used in portable and fixed methane, propane, isobutane gas detectors, as well as various combustible gas detection occasions and equipment.

4.Appearance and dimension

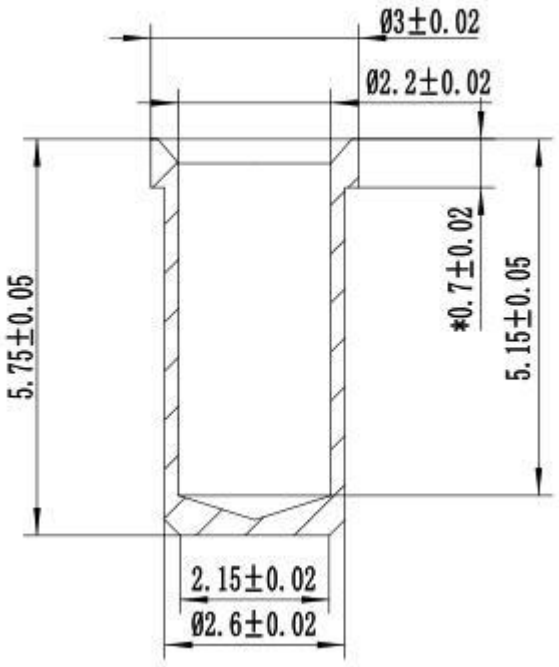


5.Technical specifications

Product model	ZC101
Detection gas	Methane, propane, isobutane
Detection range	Unit LEL: 0~100%LEL
	Unit ppm Methane: 0~50000PPM
	Unit ppm Propane: 0~22000PPM
Operating voltage	5V±0.1V DC
Operating current	≤170mA
Output	UART output(TTL level, 3.3V)
Alarm point	Over report: 50% LEL Under report: 20% LEL
Response time T90	≤10S
Recovery time	≤30S
Warm-up time	3 minutes
Resolution	1ppm
Design life	3~5 years
Operating temperature	temperature: -40~70℃ humidity: 15%~95% RH(No condensation)
Storage temperature	temperature: -20~60℃ humidity: 15%~90% RH
Size	Φ23.5*24.5mm

PinDefinition:

GND	Power Ground
VCC	Supply voltage
EARTH	Earth
RXD	Serial port input
TXD	Serial port output



Communication Protocol:

1. General Settings

Baud rate	9600
Data bits	8
Stop bits	1
Parity bits	no

2. Communication Description

The module has two communication modes: question-and-answer mode and active upload mode. The module is in question-and-answer mode by default when it is powered on. If the module does not receive a command frame from the application after 30 seconds in question-and-answer mode, it will switch to active upload mode. In active upload mode, the module will send the current concentration value (in

hexadecimal) every second. In active upload mode, if the module receives a downlink data frame from the application, it will immediately switch to question-and-answer mode.

3 Communication commands

Active sending mode

Receive	0	1	2	3	4	5	6	7	8
	Start bit	Gas name	unit	Decimal Places	High gas concentration	Low gas concentration	Alarm flag high	Alarm flag low	Check sum
	0xFF	0x01	0x03	0x00	0x00	0x00	0x00	0x00	0xFC
EXP.	FF 01 03 00 00 00 00 00 FC								

Gas name 0x01 represents methane gas, the uploaded unit is ppm, and the full scale is 50000ppm. 0x0A represents propane gas, the uploaded unit is ppm, and the full scale is 22000ppm. 0x32 represents methane, propane, and isobutane, the uploaded unit is %LEL, and the full scale is 100%LEL.
Unit 0x03 represents ppm. Unit 0x01 represents %LEL.
Decimal digits 0x00, which means that the uploaded gas concentration value is an integer, and the decimal digits are 0.
Note: When the decimal digits are 0, the resolution is 1;
When the decimal digits are 1, the resolution is 0.1;
When the decimal digits are 2, the resolution is 0.01.
Gas concentration value = (gas concentration high bit * 256 + gas concentration low bit) * resolution.

The alarm flags are defined as follows:

D16	D15	D14	D13	D12	D11	D10	D9	D8	D6	D7	D5	D4	D3	D2	D1	D0
0	0	0	0	0		0	0	0	0	0	Reserve	Reserve	Reserve	Sensor fault flag	High report sign	Low report sign

D0: Low alarm flag: 1, the module detects a concentration that exceeds the low alarm setting value; 0, the module detects a concentration that is lower than the low alarm setting.

D1: High alarm flag: 1, the module detects a concentration that exceeds the high alarm setting value; 0, the module detects a concentration that is lower than the high alarm setting.

D2: Sensor fault flag: 1, the module detects a sensor fault; 0, the module detects that the sensor is normal.

Question and answer mode

0x86 Read sensor concentration command frame

1	0x86	Read sensor concentration							
Send	0	1	2	3	4	5	6	7	8
	Start bit	address	order	--	--	--	--	--	Check sum
	0xFF	0x01	0x86	0	0	0	0	0	0x79
EXP.	FF 01 86 00 00 00 00 00 79								
Module response	0	1	2	3	4	5	6	7	8
	Start bit	order	Sensor Concentration value		Reserve	Reserve	Reserve	Reserve	Check sum
	0xFF	0x86	High Byte	Low Byte	High Byte	Low Byte	0	0	
EXP.	FF 86 00 00 00 00 00 00 7A								

Gas concentration value = gas concentration high * 256 + gas concentration low.

0x88 Command frame for calibrating the module

1	0x88	Read sensor concentration							
Send	0	1	2	3	4	5	6	7	8
	Start bit	address	order	Calibration point high byte	Calibration point lowbyte	--	--	--	Check sum
	0xFF	0x01	0x88	0	0	0	0	0	0x77
EXP.	FF 01 88 00 00 00 00 00 77								
Module response	0	1	2	3	4	5	6	7	8
	Start bit	order	If the calibration successful ?	Reserve	Reserve	Reserve	Reserve	Reserve	Check sum
	0xFF	0x88		0	0	0	0	0	
EXP.	FF 88 01 00 00 00 00 00 77								

Send: calibration point high byte * 256 + calibration point low byte, which is the concentration point to be calibrated.

For example: 0 means the calibration gas is clean air.

The unit is ppm module, 0x2710 means the calibration gas is 10000ppm; 0x4e20 means the calibration gas is 20000ppm.

The unit is %LEL module, 0x14 means the calibration gas is 20%LEL; 0x32 means the calibration gas is 50%LEL.

Response: Whether the calibration is successful: 0x01, calibration is successful, 0x00, calibration is unsuccessful.

Unit %LEL and ppm correspondence table:

Gas name	Unit(ppm)	Unit(%LEL)
Methane	50000	100
	25000	50
	10000	20
	500	1
Propane	22000	100
	11000	50
	4400	20
	220	1
Isobutane	18000	100
	9000	50
	3600	20
	180	1

Note: The default parameters of the product are methane gas and the unit is ppm. If you need to place an order for other gases, please note the gas type and unit.

4.Checksum calculation

/**

Function name: ucharFucCheckSum(uchar *i,ucharln)

Function: Sum check(Take the inverse sum of 1\2\3\4\5\6\7 of the sending and receiving protocols and add 1)

Function description: Add the elements 1 to the second-to-last element of the array and then invert it + 1 (the number of elements must be greater than 2)

**/

```
unsigned char FucCheckSum(unsigned char *i,unsigned char ln)
{
unsigned char j,tempq=0;
i+=1;
for(j=0;j<(ln-2);j++)
{
```

```
tempq+=*i;
i++;
}
tempq=(~tempq)+1;
return(tempq);
}
```

Precautions:

1. Situations that must be avoided:

Although this module uses an anti-silicon poisoning sensor, it does not mean that the sensor can be placed in a silicon-containing environment. The module should avoid:

1.1 Exposure to volatile silicon compound vapor. The module should avoid exposure to silicone adhesives, hair spray, silicone rubber, putty or other places where volatile silicon compounds exist. Otherwise, the sensitivity of the module will be reduced or even unresponsive.

1.2 Highly corrosive environment. When the module is exposed to high concentrations of corrosive gases (such as H2S, SOX, Cl2, HCl, etc.), it will cause corrosion or damage to the sensor heating material and sensor leads in the module, and will cause irreversible deterioration of the performance of the sensitive material, thereby affecting the performance and accuracy of the module.

1.3 Contact with water. If the sensor in the module is splashed with water or immersed in water, the sensor's sensitivity will decrease, which will affect the module's measurement accuracy.

1.4 Freezing. Freezing on the surface of the module's sensor sensitive material will cause the sensitive layer to break and lose its sensitive characteristics.

2. Avoid situations as much as possible

2.1 Condensation. Under indoor use conditions, slight condensation will have a slight effect on the performance of the sensor in the module. However, if water condenses on the surface of the sensitive layer and remains for a period of time, the sensor characteristics in the module will decrease and the measurement error of the module will increase.

2.2 In high-concentration gas. Regardless of whether the module is powered on or not, long-term placement in high-concentration gas will affect the sensor characteristics in the module. Such as using lighter gas.

2.3 Long-term storage

When the module is stored for a long time without power, the resistance of its sensor will have a reversible drift, which is related to the storage environment. The module should be stored in a sealed bag that does not contain volatile silicon compounds. Modules that have been stored for a long time need to be powered on for a longer time to stabilize before use. The storage time and corresponding aging time recommendations are as follows:

Storage time	Recommended aging time
Under 1 month	No less than 48 hours
1-6 month	No less than 72 hours
6 months and above	No less than 168 hours

2.4 Long-term exposure to extreme environments

Regardless of whether the module is powered on or not, long-term exposure to extreme conditions such as high humidity, high temperature or high pollution will seriously affect the performance of the module.

3. It is forbidden to directly weld the pins of the module. The socket of the pin can be welded. The size of the socket is shown in Figure 2.

4. The module cannot withstand excessive impact or vibration.

5. Do not use this module in systems involving personal safety.

6. Do not install the module in a strong air convection environment.

7. The data actively uploaded by the module through the serial port is the real-time concentration value in the current environment. In the absence of standard gas, please do not try to calibrate the command. This command will cause the calibrated data to be cleared and the serial port return data to be inaccurate.

8. To determine whether the module communication is normal, it is recommended to use a USB to TTL tool (communication level 3.3V) and use the serial port debugging assistant software to observe and judge according to the communication protocol.